This chapter investigates, documents and conveys the design process and development. The chapter firstly introduces the conceptual thinking behind the design. This is followed by a description of the design process followed during the production of the hand knotted textiles. Whereafter an overview of the test sites, the site for intervention and the programme is presented. The design process is documented in cycles and each cycle includes a variety of sketches, photo studies, diagrams and textual documentation. All documentation of the design process and development can be found in APPENDIX B and C.

"Always design a thing by considering it in its next larger context—a chair in a room, a room in a house, a house in an environment, an environment in a city plan."

-Eliel Saarinen

This chapter investigates, documents and conveys the design process and development. The chapter firstly introduces the conceptual thinking behind the design. This is followed by a description of the design process followed during the production of the hand knotted textiles. Whereafter an overview of the test sites, the site for intervention and the programme is presented. The design process is documented in cycles and each cycle includes a variety of sketches, photo studies, diagrams and textual documentation. All documentation of the design process and development can be found in APPENDIX B and C.
5.1. CONCEPTUAL THINKING

Throughout the dissertation, the terms traditional and alternative are visible. These concepts are posed against each other and the resulting paradox contributes to the decision-making process. In this way, the dissertation investigates how traditional ideas, methods, material use, and applications can be translated alternatively. The conceptual thinking is illustrated through the following illustrations:

Figure 5.2. Traditional versus alternative diagram (Various sources) (below)
Figure 5.3. Conceptual image board (Various sources) (right)

The conceptual approach diagram represents various manual construction methods that exist within the realm of textile craft. For each method of construction, there are various examples. The examples are also split into the two categories ‘traditional’ and ‘alternative’. Traditional examples are found left of the cut line, while alternative examples are right of the cut line. The conceptual diagram also serves as a ‘pasteboard’ for a range of small precedents. Textile construction methods explored in the diagram include:

- Fabric (Material)
- Sewing (Post-production)
- Cross stitch (Post-production)
- Macramé (Post-production)
- Knitting * (Pre-production)
- Weaving * (Pre-production)
- Crochet * (Pre-production)

*Represents pre-industrial textile production techniques where lace-making is the fourth manual fabrication technique.
5.2. DESIGN PROCESS

The principles of Action Research - planning, acting, and critically analysing - form the basis of the iterative design process within this study.

The Action Research method is responsive to the design situation in a way that many other research methods can’t be (Dick, 2000) – rendering it appropriate to the investigation of the process of knowing through making.

Figure 5.4. Design process diagram (below), indicates the way in which the Action Research method is applied in this dissertation. Each rectangle firstly represents one of the steps typically present in the process of manual textile fabrication. See Figure 5.19. Typical steps in manual textile fabrication, poster 12 (page 58). In addition to representing the Action Research method within the rectangles, the test sites and intervention site are also indicated within the rectangles as an integrated part of the process.

The process of planning, acting and critically analysing always takes place in the same order, but, the process is not always initiated in the same rectangle (as indicated by the arrows above and below the rectangles). Each design cycle is recorded and the observations made at the end of each cycle forms the basis for the plan of action set out for the ensuing cycle. Refer to Table 5.5. Test matrix on poster 12 (page 58).

The design process takes place within the various sites, which respond to various scales of design investigation. The first two sites are the test sites. The first of the two test sites is focused on detail design (the fabrication of a textile through the method of knotting) and the second test site is focussed more on the spatial manipulation of the textile space-definer. The site for intervention is the final physical manifestation of the textile space-definer. This spatial manifestation realises the theory discussed on spatial definition in CHAPTER 3. The cycles of design incorporate a response to all three of these sites, with planning, acting and critical reflection as part of each of the cycles. (It is however important to note that the iteration process is not necessarily a linear process. The design response might move two boxes to the right on the diagram and then one step to the left. It does not mean that the next design steps would be back to the right.

Figure 5.4. Design process diagram

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5.3. SITES FOR MAKING AND TESTING

Section 5.2. Design process offers a visual representation of the iterative design process. This process is represented by means of a process icon at the top of pages where appropriate. The process icon is based on Figure 5.4. The design process diagram.

The iterative cycles, employing various sites, ensure that design is considered on a larger intervention scale as well as on a more detailed and focussed scale.

The iterative cycles therefore allows for the comprehensive development of the eventual textile space-definer. The three test sites act as neutral 'areas' for the making and testing of the knotted textile. Each of the test sites have their own parameters and characteristics. The test site for intervention allows the textile to be tested on human scale, as a spatial manifestation. See APPENDIX A for the process of construction for the Testing frame and Testing box.

See section 5.3.1. Testing frame, 5.3.2. Testing Box and 5.3.3. Testing site for intervention on poster 10 (following page) for a discussion on each of the sites. Tables 5.1. - 5.3. provide feedback in terms of observations made during the design process and the specific response to each of the observations. These observations and responses are findings related specifically to construction of the site, its parameters and issues that surfaced while working and designing within the sites.
5.1.3. TESTING BOX

The testing box is not designed according to a specific scale but allows for the testing of knotted textiles in a three-dimensional setting. One could imagine the horizontal surface of the box as a floor or ceiling of an interior space and the vertical panels of the box as the walls. Therefore testing is done to discover spatial response and not the solving of construction details on a scale of 1:1 as with the testing frame.

Construction parameters of the testing box were derived from knowledge gathered throughout the iterative process. See Table 5.1. This includes responses as seen in Table 5.1-5.3 (below). Figure 5.7. Test type diagram; poster 11 (page 57) indicates that test completed within the framework of the box would fall under category A and B rigid and semi-rigid testing. See APPENDIX A for construction process of the testing box. See Figure 5.8. View of test box (below) and Figure 5.9. Test box, scale 1:10, and Figure 5.10. Test box exploded view.

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TEST SITE PARAMETERS

Table 5.2. Test box, observation and response.

<table>
<thead>
<tr>
<th>Observation</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand mdf to remove glue and pencil marks</td>
<td>Corefil ease, causes tension</td>
</tr>
<tr>
<td>Mark exterior surface with grid, drill holes</td>
<td>Plane with a countersink drill bit at 90°</td>
</tr>
<tr>
<td>Cut MDF panels, glue and screw together</td>
<td>Sand it down</td>
</tr>
<tr>
<td>Insert eye bolts and threaded rod</td>
<td>Sand it down</td>
</tr>
<tr>
<td>A threaded rod was added to compensate</td>
<td>Sand it down</td>
</tr>
</tbody>
</table>

Figure 5.8. View of test box (directly below) and Figure 5.9. Test box, scale 1:10, and Figure 5.10. Test box exploded view.

Table 5.2. Test box observation and response.
5.3.3. TESTING SITE FOR INTERVENTION

The site for intervention forms part of the process of iteration and acts as a spatial informant. Within the structure of the dissertation, the site for intervention acts as a site within which to investigate and display the spatial manifestation of the knotted textile. The focus of the study remains primarily on the design process, with the product of the process as the primary research contribution.

The selected site is the first year studio in the Building Sciences Building (Boukunde) on the Main Campus of the University of Pretoria. This building houses the Department of Architecture, with programmes in Architecture, Interior Design, and Landscape Architecture. See Figure 5.11. View of test site for intervention (directly below) and Figure 5.12. Test site for intervention, not to scale, and Figure 5.13. Existing traditional space-defining elements.

Observation Response

Working on plan too early in the design process resulted in a very traditional first design response in terms of material choices, form and spatial thinking. Instead of continuing on plan, design was moved back to the test frame and an exploration of material uses. Inspiration was also taken from various images and resulted in the formulation of image boards. Afterward, the design process returned to the site for intervention.

Due to a fairly limited understanding of the potentials and limitations that the material offers, it was hard to determine an alternative spatial response. A design charrette was done using existing knowledge and skills. This traditional response and understanding would then be ‘translated’ into an alternative response.

Design on plan reached a certain level of development when new textile ideas or input was needed. Design response was spatially appropriate in terms of movement through space, but form and aesthetic did not speak the same language as the use. Various images were found online to create an Image board. These images indicate ideas of textiles in tension, textiles as suspension systems, and cable-stayed structures and designs. Design process returned to section, plan and detailing.

Table 5.3. Test site for intervention, observation and response.

<table>
<thead>
<tr>
<th>Observation</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working on plan too early in the design process resulted in a very traditional first design response in terms of material choices, form and spatial thinking. Instead of continuing on plan, design was moved back to the test frame and an exploration of material uses. Inspiration was also taken from various images and resulted in the formulation of image boards. Afterward, the design process returned to the site for intervention.</td>
<td>Due to a fairly limited understanding of the potentials and limitations that the material offers, it was hard to determine an alternative spatial response. A design charrette was done using existing knowledge and skills. This traditional response and understanding would then be ‘translated’ into an alternative response.</td>
</tr>
<tr>
<td>Design on plan reached a certain level of development when new textile ideas or input was needed. Design response was spatially appropriate in terms of movement through space, but form and aesthetic did not speak the same language as the use. Various images were found online to create an Image board. These images indicate ideas of textiles in tension, textiles as suspension systems, and cable-stayed structures and designs. Design process returned to section, plan and detailing.</td>
<td></td>
</tr>
</tbody>
</table>
5.3.5. REFLECTION (ONE)

During the planning phases of the test sites, certain design and construction assumptions were made. These assumptions were based on knowledge accumulated from precedent studies and literature reviews. See Chapter 3: Literature study. This was used as the starting point for decisions made in terms of the parameters that would be used for construction of the test sites. After designing using the textiles within each of the individual sites, it became clear that some of the initial assumptions were incorrect. A number of changes and refinements could then be made based on the new knowledge collected during the making and testing phase. These observations and responses are discussed within Table 5.1-5.3 on poster 10 (page 55).

Research through making implies gaining knowledge through the process of making. The process of designing and testing the test sites clearly illustrated this to me. This was an important step for me as it demonstrates the importance of the process of plan, act, observe and reflect. It also demonstrates the importance of action plans based on knowledge that was gained during the actual making part of the process. Instead of knowledge collected through the typical research style, this type of knowledge could potentially gain a more accurate design response the first time around.

Through reflection certain deductions were made concerning the nature of the test sites. See Figure 5.17. Textile systems in section 5.3.5.1. Analysis on poster 11 (opposite page).

5.3.4. TESTING MATERIALS

The tests were completed by making use of found materials – textile strips and rope in particular. It is however important to note that the dissertation is not an exercise in the reuse, recycling or upcycling of found rope or rope-like materials. The test materials are representative of the final materials but not identical nor indicative of the final material or aesthetic palette.

ROPE: Initially string, rope and various other cordage was purchased in small sections. See Table 5.4. Rope types on poster 11 (opposite page). Initial rope choices were limited by price and availability of the material in one metre increments (instead of an entire roll of rope). Testing involved knotting, flexing, pulling and bending the rope to obtain a sense of the character of the rope. Finally 5mm and 7mm cotton rope was selected as the main material to use for sample testing. See figure 5.15. Selected testing cordage on poster 11, (opposite page).

ROPE-LIKE MATERIALS: See definition for rope-like materials in CHAPTER 1, page 9. Due to availability, cotton fabric in 15mm wide strips were selected for sample testing. These strips were off-cuts from Design team fabric. See Figure 5.14. below for an image of Design team fabric and more information on Design Team. The process involved knotting strips together, documenting the results (textual, sketches, diagrams and photos) and then taking these apart to construct new samples. See section 5.6. Design cycles for an example of documentation, also see APPENDIX B and C. Samples that illustrate pertinent design process of construction were kept aside for final exhibition.

ASSISTIVE TESTING HARDWARE: The primary hardware items used can be seen in Figure 5.18. Main assistive testing hardware, (opposite page).

Figure 5.14. Photo of Design team fabric (right).

DT Designs cc trading as Design Team is a textile design business focusing on the design, print and conversion of South African inspired textiles. Contemporary, topical designs form the basis of our fabric collections, rather than the already well represented ethnic approach. (Designteam, 2011).

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5.3.4.1. MATERIAL USE

NOTE that the dissertation is not an exercise in the reuse, recycling or upcycling of found rope or rope-like materials. The test materials are representative of the final materials but not identical nor indicative of the final aesthetic of material palette. Refer to section 5.3.4 Testing materials (page 56) for more information of the various testing materials and images. Find below the definitions for rope and rope-like materials.

Rope:
A length of thick strong cord made by twisting [braiding or plaiting] together the strands of hemp, sisal, nylon, or similar material.

Rope-like:
Any textile that exhibits similar characteristics to those of rope (as defined above) or that can be knotted and handled in a similar manner to rope.

5.3.4.5. ANALYSIS

Three kinds or systems of textile interaction existent. These systems are illustrated on the diagram to the right.

- test frame performs as rigid grid system, TYPE A on Figure 5.17.
- test box performs as semi rigid system, TYPE B on Figure 5.17.
- test site performs as most flexible system, TYPE C on Figure 5.17.

This information could not be gained by means of traditional research methods at the beginning of the study. These facts were gained purely by means of making.

Table 5.4.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Material</th>
<th>Structure</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sash cord</td>
<td>Cotton</td>
<td>Double braid</td>
<td>Shared load</td>
</tr>
<tr>
<td>2</td>
<td>Sash cord</td>
<td>Cotton</td>
<td>Double braid</td>
<td>Shown load</td>
</tr>
<tr>
<td>3</td>
<td>Sash cord</td>
<td>Viscose</td>
<td>Knit</td>
<td>Stretch</td>
</tr>
<tr>
<td>4</td>
<td>Sash cord</td>
<td>Polyethylene</td>
<td>Three strand twisted</td>
<td>Rotational force</td>
</tr>
<tr>
<td>5</td>
<td>Fabric strip</td>
<td>Cotton</td>
<td>Weave</td>
<td>Increased surface area</td>
</tr>
</tbody>
</table>

Figure 5.15. Selected testing cordage

Figure 5.16. Rope-like materials.

Figure 5.17. Test type diagram.
Test Matrix for Design Cycles

### 5.6. Test Matrix

The test matrix is a table with a summary of the results of the design cycles. Each sample test was modeled and recorded within the test matrix. See Table 5.6. Test matrix. Below are further examples of each test sample. Each test cycle 1-29 was designed to test different aspects of the textile and its interaction with the board. The matrix displays the following information:

- **DATE**
- **Test Name**
- **Experiment**
- **Notes**
- **Observations**
- **Response and Questioning**

#### Table 5.5: Test Matrix

<table>
<thead>
<tr>
<th>DATE</th>
<th>Test Name</th>
<th>Experiment</th>
<th>Notes</th>
<th>Observations</th>
<th>Response and Questioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>04_06</td>
<td>#1776 Hitch</td>
<td>POSTER chapter 558</td>
<td>#1776</td>
<td></td>
<td></td>
</tr>
<tr>
<td>08_06</td>
<td>10_06</td>
<td>ACTION AND OBSERVATION</td>
<td>10_06</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Diagram 5.3: Typical Steps in Textile Generation

- **Stage 1: Fibers**
- **Stage 2: Yarn**
- **Stage 3: Fabric**
- **Stage 4: Frame**
- **Stage 5: Application**

#### Table 5.5: Test Matrix

<table>
<thead>
<tr>
<th>DATE</th>
<th>Test Name</th>
<th>Experiment</th>
<th>Notes</th>
<th>Observations</th>
<th>Response and Questioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>29_05</td>
<td>Hitch</td>
<td>POSTER chapter 558</td>
<td>Hitch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31_05</td>
<td>04_06</td>
<td>ACTION AND OBSERVATION</td>
<td>04_06</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes

- Sample change occurs when design moves here and test site to another. Other tests would be a site where design changes are done. Scale changes are indicated in the flow diagram on the opposite page (poster).
5.5. FLOW DIAGRAM

The diagram represents the process of making. The process starts at the identification of three types of space (numbered 1,2,3). Each type of space requires a different type of textile. This is divided into categories of density.

The arrows indicate the path of the process, while the number within the dark blue circle indicates the test number. The test number on the diagram correlates with the test number as found in the TEST MATRIX. All procedures and observations are documented in the Test Matrix. Refer to the key below the diagram for further instructions.

Figure 5.20 Flow diagram.
5.4.1. Thick textile 1

From the onset of the first test, the framework for the creation of the first test sample was based on the proposed programme. The programme requires three basic types of interior spaces: Private space, semi-public space and public space. The design response investigates three types of textiles that would fulfil the requirements for each of these interior spaces. The first cycle focuses on a material that is thick and dense.

Conclusions were reached in terms of:

Possible spatial functionality: The sample is quite thick and can act as a strong visual barrier. The sample could potentially be used to create a space-defining private interior spatial zone. Use of the material is quite flexible due to the thickness of the rope used. A substantial length of rope results in a small sample surface area. Research on the knot type and category took place after the completion of the first test sample.

Potential: The textile sample allows for stretchability, flexibility, coverage, density. It can also act as a visual barrier; influence the acoustic quality of a room and be visually appealing.

5.4.2. Thick textile 2

Thick textile 2 is a response to the observations made after the construction of thick textile sample 1. Conclusions were reached in terms of:

Possible spatial functionality: The sample is quite thick and can act as a strong visual barrier. The sample could potentially be used to create a vertical space-defining private interior spatial zone. Use of the material is slightly more rigid than thick textile sample 1. The openings between the knots are larger than in thick textile sample 1.

Potential: The textile sample is visually appealing and could be employed as a vertical space-defining yet still allowing for visual connection between spatial zones. The softness of the textile sample could potentially soften the feel of an interior zone. The nature of construction allows for various configurations of colour and pattern which need to be explored further.
The spacing of the Primary Cord by means of a hard product, is a response to the initial observation that the thick textile sample appeared 'flat'. Secondly, the form and functionality is a response to the spatial quality of the proposed site of intervention. The sample aims to offer the user the opportunity to adjust the conditions of the interior space as a response to light, sound and visual influences.

Possible spatial functionality: The adjustable panel within the sample allows for customizable spatial zones. The textile sample is noticeably deeper than sample 1 and 2, allowing for the creation of a more articulated spatial divider.

Aesthetic and tactile quality: The sample is reminiscent of a flexible, moving idea of interior furnishings that deviates yet remains quite traditional due to the board. Knot and material selection: The use of a hard product is considered to define the sample as fixed, more traditional quality and appearance. The material choice should be reconsidered.

Possible potential: The adjustable nature of the sample allows for adaptable spatial zones.

5.4.4. Adjustable space-definer iterations

The first adjustable space-definer employs hard board materials. The tensions of the adjustable space-definer makes use of the thick textile samples from test one and two. The sample aims to offer the user the opportunity to adjust the conditions of the interior space as a response to light, sound and visual influences. The use of the softer textile transforms the traditional hard blind into a softer alternative.

Conclusions were reached in terms of:

Possible spatial functionality: The adjustable panels within the sample allows for customizable spatial zones. The textile sample is noticeably deeper than samples 1 and 2, allowing for the creation of 'thicker' spatial definition. The softer, more permeable nature of the textile blind would potentially respond better to environmental factors than the solid hard board. These factors could include sunlight, auditory and visual noise.

Aesthetic and tactile quality: The sample is reminiscent of a window blind evoking ideas of interior furnishings and decoration. The textile blind accentuates these ideas of decorativeness, softness and femininity.

Knot and material selection: The fusing knots employed are not ideal and should be reconsidered. Main knot and material selection discussed on page one.

Possible potential: The adjustable nature of the sample allows for adaptable spatial zones. The soft textile allows for design opportunity in terms of 'soft' space.
5.4.5. Rigidity

The board as horizontal element is naturally rigid. When replacing the board with a textile sample the rigidity is reduced. Knot choices in terms of tying as well as other 'hard' materials need to be added to the textile to provide adequate rigidity. Conclusions were reached in terms of:

- **Possible spatial functionality:** The fastening methods and insertion of stiff materials (such as a dowel) allow for rigidity within the textile sample. This rigidity is employed to ensure structural stability of textile-space defining elements.
- **Aesthetic and tactile quality:** The use of the dowel as rigid material within the textile does not detract from the soft and fluid quality of the textile sample. Knots, especially strong and rigid, provide a finished and rounded look to the product.
- **Knot and material selection:** The knots used for tying provide ample structure.
- **Possible potential:** The textile sample can span further and with more ease than without added rigidity. This would allow for larger sections of vertical or horizontal space-defining elements to be covered or divided. The knotting techniques investigated can be employed at various stages throughout the construction process.

5.4.6. Spatial Exploration

When certain points within the sequence of the design process is reached, a jump in scale occurs. Between tests 12 and 13 the spatial intervention was investigated on plan and various quick perspective sketches.

The following conclusions were reached:

- When assessing the sketches and plans drawn it is apparent that conventional design methods result in conventional design proposals. This is especially noticeable in sketches that the plans take on as well as the representation of solid volumes inserted into the existing space.
- Knowing through making focuses on the creation of data instead of the collection of data. The importance of the process is clear in the design that resulted when the focus of the research was shifted to more conventional methods.

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5.4.7. Lighter textile

The lighter textile sample is a response to the conclusions reached during the rigidity cycle. The lighter textile sample is the second type of textile that can be applied in the formation of semi-private spatial zones. (See process diagram).

Conclusions were reached in terms of:

Possible spatial functionality: The textile is considerably lighter than thick textile sample 1. The textile could sufficiently define semi-private spatial zones.

Aesthetic and tactile quality: The openings between knots are larger and provide less visual obstruction than the thick textile samples. The knot sequence creates an organised and recognisable pattern. The sample is looser than sample 1 and 2.

Knot and material selection: The selected rope-like fabric provides sufficient bulk for the construction of a textile that remains thick but is lighter and less dense. The selected knot type remains as is and provides opportunity for the adjustment of the overall textile pattern and look.

Possible potential: Similar to previous textile samples the nature and composition of the textile allows for variations in colour and pattern. The reduced weight of the textile is beneficial overall as it influences how the textile can be structure, fixing points and methods of insertion.

5.4.8. Planar irregularity

The planar irregularity cycle returns to the original textile samples created. The cycle employs the same knot as applied to the first sample tests, but introduces subtle changes in procedure.

Conclusions were reached in terms of:

Possible spatial functionality: The sample is quite thick and can be used to create a strong visual barrier. The sample can be a space-definer for a private interior spatial zone.

Aesthetic and tactile quality: The knotted textile has a defined knot pattern on one side and a more irregular pattern on the other side. (See section 1.6. Definition of terms: Developed terms on page 9). The distinctive visual quality of the textile sample is very different from that achieved during the first sample tests. The textile feels soft to the touch and has a very pliable and malleable quality to it. Knot and material selection: By simply changing the direction of knotting the result is changed completely. The structural behaviour of the textile responds in a significantly different manner than that of the thick textile sample one and two.
Figure 5.54. Image board (Various sources).
Knot:
An interlacing of the parts of one or more flexible bodies forming a lump or knots (as for fastening or tying together) (Merriam-Webster: knot). An intertwined loop of rope, used to fasten two similar ropes to one another or to another object. A knot even when not in use, will hold its shape or form.

Overhand Knot
ABOK # 46
The overhand knot is the simplest of the single-strand stopper knots, tied by passing one end around the other and back again, then pulling the free end to tighten the knot. This knot is always used with a double stopper. It may also be used in conjunction with a simple slipknot. It can be used on its own as a simple stopper knot.

Double Fisherman’s Knot
ABOK # 415
The Double Fisherman’s Knot is also known as the Grappling knot or Double English Knot. This variation of the Fisherman knot is a very useful knot that is used in all search and rescue operations. All variations of this knot are too jam, even under strain, and in situations where the knot needs to be easily untied other knots are preferred.

Simple Noose Knot
ABOK # 114
The simple noose knot is a variation of the Overhand knot. The best technique is to pass the end of the rope through the loop. The simple noose knot is often used in situations where a loop is needed in a rope. It is best used in situations where the rope is already looped in a knot.

Lark’s Head Knot
ABOK # 265, 56
The Lark’s Head is also known as the Clove Hitch. It is the knot most commonly used in square knotting or Macrame. Square knotting is started with a series of cords made. Set to a four or five loop knot, by means of a Lark’s Head Knot.

Clove Hitch Knot
ABOK # 176-180, 177-1777
The Clove Hitch is a simple yet useful knot. It is used to secure more complex hitches, or to make rope more manageable, to temporarily secure small boats, or to hinge, without it finding around a Carabiner and as a general utility knot. The Clove Hitch can be used in the right or with the Wrong End.
5.7 PLANNING PART TWO

After the design cycles as documented in the test matrix, a second Plan of Action was set out. As with the plan of action part one, the table includes a number indicating the phase, a description of the action performed within that specific phase, the research technique applied and the purpose for the action. Further information such as the primary source used as basis for the action, the time frame to perform the action, as well as the physical manifestation of the action performed is included.

<table>
<thead>
<tr>
<th>PHASE</th>
<th>ACTION</th>
<th>RESEARCH TECHNIQUE</th>
<th>SOURCE</th>
<th>MATERIAL</th>
<th>PURPOSE</th>
<th>TIME FRAME</th>
<th>PHYSICAL MANIFESTATION</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Review spatial intervention and documentation</td>
<td>Observation</td>
<td>PHASE 6.10</td>
<td>N/A</td>
<td>Determine spatial intervention</td>
<td>Incremental process</td>
<td>Sketches, plans, sections, perspectives and spatial representations</td>
<td>Spatial intervention will be ready to be built between PHASE 7.2. Spatial intervention will be handed over to the client after the final phase of design has been completed</td>
</tr>
<tr>
<td>12</td>
<td>Set up documentation procedures</td>
<td>Design response</td>
<td>PHASE 6.5</td>
<td>N/A</td>
<td>In place for rigorous documentation of the process</td>
<td>1 DAY</td>
<td>Details and data for data collection and documentation process</td>
<td>The documentation procedure is reviewed in house after the final phase of design has been completed</td>
</tr>
<tr>
<td>13</td>
<td>Model and map the materials on a spatial level within testing model 2</td>
<td>Preparing phase one</td>
<td>PHASE 7.1</td>
<td>N/A</td>
<td>Model and map the materials on a spatial level</td>
<td>Continuous process</td>
<td>Photographs, sketches and project specifications are collected as well as possible details and manifestations</td>
<td>The documentation procedure is reviewed in house after the final phase of design has been completed</td>
</tr>
<tr>
<td>14</td>
<td>Analyse software</td>
<td>Drafting</td>
<td>PHASE 7.3</td>
<td>N/A</td>
<td>Processes of data in order to reach an appropriate conclusion and well thought conclusion</td>
<td>Continuous process</td>
<td>Previou data in excel spreadsheet</td>
<td>Observations and conclusions are of the utmost importance</td>
</tr>
<tr>
<td>15</td>
<td>Investigate the use of ‘old’ or ‘right’ elements</td>
<td>Preparing phase two</td>
<td>PHASE 1.1</td>
<td>N/A</td>
<td>Investigate the use of ‘old’ or ‘right’ elements</td>
<td>1 WEEK</td>
<td>Specialist and commissions of other software types and data analysis</td>
<td>Observations and conclusions are of the utmost importance</td>
</tr>
<tr>
<td>16</td>
<td>Preparate spatial intervention according to intervention site</td>
<td>Design response</td>
<td>PHASE 6.10</td>
<td>N/A</td>
<td>Preparing spatial intervention for the design of space planning procedure</td>
<td>1 WEEK</td>
<td>Materials and finishing, planning and installation</td>
<td>Spatial intervention will be ready to be built between PHASE 7.2. Spatial intervention will be handed over to the client after the final phase of design has been completed</td>
</tr>
<tr>
<td>17</td>
<td>Plan and colour selection</td>
<td>Design response</td>
<td>PHASE 6.1</td>
<td>N/A</td>
<td>Plan and colour selection</td>
<td>1 WEEK</td>
<td>Samples and diagrams, colour studies and plans</td>
<td>Materials and finishing, planning and installation</td>
</tr>
<tr>
<td>18</td>
<td>Investigate and determine the character of the materials</td>
<td>Preparing phase two</td>
<td>PHASE 1.1</td>
<td>N/A</td>
<td>Investigate and determine the character of the materials</td>
<td>1 WEEK</td>
<td>Selection of materials, selection of material types, selection of materials and information</td>
<td>Spatial intervention will be ready to be built between PHASE 7.2. Spatial intervention will be handed over to the client after the final phase of design has been completed</td>
</tr>
<tr>
<td>19</td>
<td>Technology</td>
<td>Analysis literature</td>
<td>PHASE 6.5</td>
<td>N/A</td>
<td>Determining the technical specifications for construction and fabrication processes</td>
<td>Technical specifications, technical drawings and specification</td>
<td>Technical specifications, technical drawings and specification</td>
<td>Technical specifications, technical drawings and specification</td>
</tr>
<tr>
<td>20</td>
<td>Documentation</td>
<td>Design response</td>
<td>PHASE 7.3</td>
<td>N/A</td>
<td>Documentation to map fabrication methods</td>
<td>Technical specifications, technical drawings and specification</td>
<td>Technical specifications, technical drawings and specification</td>
<td>Technical specifications, technical drawings and specification</td>
</tr>
<tr>
<td>21</td>
<td>Planning fabrication methods</td>
<td>Design response</td>
<td>PHASE 1.3</td>
<td>N/A</td>
<td>Planning fabrication methods</td>
<td>Technical specifications, technical drawings and specification</td>
<td>Technical specifications, technical drawings and specification</td>
<td>Technical specifications, technical drawings and specification</td>
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</table>

![Working Plan 2: Action Plan & Time Frame](image-url)
image board 2
SUSPEND AND STRETCH
5.8 DEVELOPMENT OF SCENARIOS

During the testing and making phases (using the testing box), the textile scenarios were developed. The following images illustrate the initial development of the scenarios as well as the form and use of the textile space on a spatial level.

Figure 5.58.

TEXTILE PLANE ONE, POSITION 1 (above left and right).

The textile plane is adjustable by means of a pulley system. Position one defines a spatial zone below the mezzanine as either digital classroom or a informal seating space. North of the textile plane is a formal studio space and exhibition space.

Figure 5.59.

TEXTILE PLANE ONE, POSITION 2 (above left and right).

Position two defines spatial zone three and four. Zone three combines the space underneath the mezzanine with the existing formal studio space. Spatial zone four is now an enclosed area on top of the mezzanine with access from the west using the stairs.

Figure 5.60.

LARGE SUSPENDED TEXTILE, POSITION 1 (above).

The large suspended textile plane is considered a combination of horizontal and vertical planes. The structure is suspended by two static, permanent anchor points.

The exhibition and digital presentation sees the textile suspended from the existing overhead plane and fixed in position to define a more enclosed or restricted area at the southwest corner of the existing studio space. This area can be used in various formations for digital projection and exhibition or presentations. Here the mezzanine incorporated within the proposed mezzanine act as amphitheatre seating.

Figure 5.61.

POSTER chapter 568

22
5.9. DESIGN RESPONSE

The Boukunde site for intervention acts as a shell for the textile intervention, firstly a hard element is inserted into the space—a cable-stayed mezzanine. This structure is not a textile space-shaping element itself but it exists as a formative base. See Figure 5.61: Design intervention diagram (bottom). With textile space-making in mind the mezzanine structure is designed to be as lightweight as possible, conceptually alluding to permeability and lightness. See section 5.1: Conceptual thinking on page 39. 

Fixing and connection details between hard and soft—mezzanine and handle space-shaping elements—are accentuated and exposed to respond to the conceptual approach. These textile space-shaping elements are designed according to the identified scenarios. See Figure 5.62: Scenario sketches (boxed below).

5.9.1. PROGRAMMING

The commitment of the Department of Architecture to innovate combined with the desire of the interior design disciplines to define and differentiate themselves from the discipline of architecture, creates the unique opportunity for the design of an INTERIOR DESIGN MAKING STUDIO for the department. See Figure 5.63: Diagram of proposed programme (right) for a bubble diagram indicating the different functions of the proposed programme. See Figure 5.64: Student allocation diagram (above). 

Table 5.8: (below) indicate the number of students for each discipline in each of the years. The Honours student occupying the Western wing of the test site for intervention (first year studio) will be relocated to the OPEN AREA indicated in red on the plan. See Figure 5.65: (bottom) illustrate with a collection of images, the current condition of the test site for intervention.

5.9.2. SCENARIO ONE—DIVISION OF GROUP WORKSPACES

The textile unit for scenario one is a semi-fixed unit (one point of the textile always remains fixed to the structure). Scenario one allows the user to create a visual barrier between group working spaces. Each textile unit can be manoeuvred individually to suit the needs of the user both at the location of the mezzanine and at the top. All the units can be neatly rolled up for easy storage. Even though the large workspaces above and below the mezzanine can be divided by the user, the textile is restricted to two vertical planes.

5.9.3. SCENARIO TWO—DIVISION OF INDIVIDUAL WORKSPACES

Scenario two offers the user more flexibility than scenario one. Each textile unit can be completely detached from the structure, allowing the user to relocate the sample to a different location. This allows the user to create a more private or enclosed space. The individual unit is equipped with colour-coded carabiners allowing various configurations of space.

5.9.4. SCENARIO THREE—DIVISION OF ROOM FUNCTIONS

Scenario three offers the potential of subdividing larger interior spaces. This allows for the creation of temporary interior within an interior setting which would potentially house different functions. Within the design studio scenario three includes the creation of a temporary digital projection space within an exhibition area.
look and feel
THE MAKING STUDIO

Figure 5.66. Look and feel (moodboard).
5.10. SPATIAL DESIGN RESPONSE

The basis for the design of the textile space-defining element is presented in the first part of this chapter in the form of design cycles, reflections and observation and response tables. The information and ideas discovered throughout the making process fully informs the spatial design response that follows.

The making process continues throughout the design development in order to enrich and contribute towards the more conventional spatial design process.

The textile samples and knowledge collected from the making process directly informs the basic textile unit. The basic textile unit is then altered to create the various spatial responses that follow. These space-defining elements are presented as part of the three scenarios as discussed earlier on poster 23, page 69. This is indicated when appropriate at the top right corner of the poster pages.

Sections 5.4.1. - 5.4.8. on posters 14-17 illustrate the initial design detailing cycles. Differently than with conventional research methods, research through making, introduces a process where smaller focussed detailing takes place before detailing on a larger scale. This section however looks at design detailing as part of the spatial manifestation. The design detailing takes place on the text site for intervention.

This section covers the following detail areas:

- the cable-stayed mezzanine
- the balustrade
- textile unit one & two
- rigging details
- the conceptual development of textile unit three

The location of each of these details are indicated on Figure 5.78. Section 1 - scenario one and two with detailing, poster 29 (page ). A small development sketch is added as reference.

NOTE: All scales indicated on drawings (plans, sections and details) apply only to full scale poster prints. All drawings indicated within the book are ‘not to scale’.
**Plans Scale 1:100**

**Scenario One & Two**

**Level 4 Plan**
- Studio layout
- Scale 1:100

**Mezzanine Plan**
- Studio layout
- Scale 1:100

**Spatial Use Diagram**
- Exhibition space
- Interior design studio space
- First year studio space
- Informal seating/entertainment area
- Digital exhibition space
- Making lab

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**FURNITURE LEGEND:**

1. Existing studio chair
2. Existing studio desk
3. Existing light tracing table
4. Two door storage unit
5. Two door storage unit, tall
6. Four door storage unit, tall
7. 300x300 mm Crochet pouffe
8. 300x300 mm Cable knit pouffe
9. Standard Off-Flax chair
10. Low Off-Flax chair
11. 100x100x100 mm powder coated mild steel and ash timber easy bench
12. Existing credenza

**ELECTRICAL LEGEND:**

- Double wall socket at height indicated above finished floor level
- 16A Slimline compact standard combined socket outlets 100x100mm
- Combo socket switch on yoke as per CRABTREE
- Colour: Black
- Part number: 6859/008
- Stainless steel coverplate
- Part number: 6529/8
- Double wall socket surface mounted to underside of concrete overhang at height indicated above finished floor level
- 16A surface mounted combined socket outlets 100x100mm
- Combo socket switch on yoke with surface mount box as per CRABTREE
- Colour: White
- Part number: 6859/008
- With additional magnetic spherical safety cover
- Colour Grey, Code: CS005
- 450x300x80 mm steel frame and MDF top work table
- 780x600x800 mm steel frame and HDF top work table

**FIRE RETICULATION:**

- 9kg Dry powder fire extinguisher: 1/200 sq/m
- Fire hydrant: 1/1000 sq/m
- Fire hose reel: 1/500 sq/m
- Fire escape
Existing main structural columns
countertop

SEATING SPACE (seats 25)

existing floortiles
line of concrete overhang overhead
cement beam overhead

line of mezzanine overhead

Removal of two strips of existing floor tiles, replace tiles with timber flooring insert

Brass edging strips to be placed on either side of timber insert

Shoulder eye bolt floor anchor-point (AP) recessed into timber strip within 70 mm diameter cutout

FIRE EXIT

amphitheatre seating (seats 20)
tread: 900
riser: 435

stair tread: 300
riser: 145

Coffee table to double up as stackable plinths

DESIGN STUDIO (seats 20)
existing floortiles

AP 1
AP 2
AP 3
AP 4
AP 5

AP 1
AP 2
AP 3
AP 4
AP 5

storage cupboard

Shelving accessible from under stair, storage of chair and amphitheatre loose pillows

adaptable textile plane

individual unit

individual unit

shelving

custom low door fitted under amphitheatre seating as access to storage area

material sample cabinets

storage unit overhead

adaptable textile plane

u1 u2 u3 u4 u5 u6 u7 u8

Stair

tread: 300
riser: 145

clerestory ribbon window

concrete beam overhead

concrete beam overhead

clerestory ribbon window

concrete overhang

concrete overhang

6150

Loose seating pillow, storage area supplied under staircase

tread: 900

riser: 435

material sample cabinets

storage unit overhead

adaptable textile plane

u1 u2 u3 u4 u5 u6 u7 u8

Stair

tread: 300
riser: 145

6 mm slip resistant recycled rubber flooring as per ECOSURFACES on mezzanine, staircase and amphitheatre seating, flooring to be sealed with Ecoguard clear coat, fixed to shutterply with Ecore E-grip 3 adhesive

Colour: Sundance

Code: 1217

Balustrade with rope design infil and timber handrail with integrated tie down cleats

340 x 180 x 6 mm cold-formed rectangular section main bearer beam suspended from existing concrete roof structure with steel cables and rods at 4000 mm centres, to be finished with 1x coat of primer and paint (spray on application)

Colour: Platinum grey, RAL 7037

7825

1530

740

1545

920 920 920 920

920 920 920 920

MATERIAL AND SAMPLE STUDIO (seats 10)

recycled rubber flooring

Figure 5.70.

SCENARIO ONE & TWO
### CEILING LEGEND:

- **Existing:** indicates existing elements that will be preserved.
- **Underside of existing concrete soffit:** all holes to be filled and sealed.
- **Surface to be sanded and prepared for painting:** the surface will be sanded and ready for painting.
- **Existing 600 x 600 suspended ceiling tiles with concealed T-grid:** the ceiling will be replaced with NEW 600 x 600 Ecophon Master Rigid A acoustic ceiling tiles fixed with Connect T24 exposed grid and accessories.

### LIGHTING LEGEND:

- **Existing luminaires to be removed:** all luminaires that are not being replaced.
- **Existing luminaires to be cleaned and lamps to be replaced:** where needed with NEW "T8" Luminous lamps (5.3W/411) as per OSRAM.

### LIGHTING CALCULATION:

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<td>Total</td>
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</table>

#### Existing

- **Surface mounted fluorescent luminaire with reflectors:** Powder coated white.

#### Adjusted existing

- **Surface mounted fluorescent luminaire with reflectors:** 1499 x 2 5200 lm 58 W

#### New

- **90 x 100 continuous surface mounted LED:** Charcoal grey (CG)

### Symbol

- **Luminaire specification Lamp specification Quantity (luminaire x lamp) Luminous flux Total Watt Total luminous flux Efficacy (lumen/watt)**
- **Existing:** Surface mounted fluorescent luminaire with reflectors. Powder coated white. 58 W "T8" Light colour 840 [cool white] [LUMILUX L58 W/840] by OSRAM

#### Table 5.9.

- **Number of lamps Lumen per lamp Luminous flux Total luminous flux Utilization Factor* Maintenance Factor* Working plane Lvl [lux] Average Illumination [lux]**
- **Existing:** 280 90 5200 1456000 0.4 0.9 758 410
- **Adjusted existing:** 258 90 5200 1341600 0.4 0.9 758 370
- **New:** 364 100 2420 638880 0.45 0.27 150 517

#### Calculation:

**Existing:**

- **Room Index (RI) =** \( \frac{W}{2H} \)

**Adjusted existing:**

- **Room Index (RI) =** \( \frac{W}{2H} \)

*LLMF and LSF for LED strip lighting, information not available. Values used for calculation taken from similar lamp type to allow for calculation.

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interior elevation 1: 20

SCENARIO ONE & TWO

SECTION 1 - SCENARIO ONE & TWO WITH DETAIL SKETCHES
SCALE 1:20
5.10.1. DEVELOPMENT OF CABLE-STAYED STRUCTURE

This mezzanine structure is not a textile space-defining element in itself but assists in the making of space. With textile space-making in mind, the mezzanine structure is designed to be as lightweight as possible. The mezzanine structure is also designed to appear as permeable as possible. Connection and fixing details are designed to remain exposed. Similar to the way in which a knot simply is what it is, revealing its structure.

The existing interior volume consists of a virtually column-free floor area. Due to the clerestory windows within the space, the concrete roof structure seems as if it floats. Two main columns or walls within the interior space act as the structure for the roof. The newly proposed cable-stayed mezzanine is suspended from the existing structure by means of cables. In this manner, the mezzanine does not make use of any additional columns, allowing for an open floorplan without obstruction.

Figure 5.79. Development of mezzanine form (right) and Figure 5.80. Sectional perspective of final form (below), shows a selection of images representing some of the various layouts, sizes and forms explored during the design of the mezzanine.

The final form of the mezzanine was influenced by the following factors:

- natural light
- meeting points between existing structure and proposed mezzanine
- structural fixing points for suspension cables
- existing studio layouts (in terms of student allocation)
- proposed programme and function of the mezzanine
- maximum potential for textile intervention

The main factor that influenced the final form of the mezzanine was the fact that the test site for intervention merely acts as a space to test the spatial manifestation of the hand-knotted textiles. This means that the mezzanine structure’s main feature is to ensure maximum testing potential. The final form does not necessarily represent the best layout in terms of movement and placement of furniture, but allows for maximum utilisation concerning the textile unit.
Existing clerestory window

Existing luminaire to be moved 700 mm from edge of concrete overhang towards southern interior facade.

Existing windows boxes, cladding to be cleaned and prepared for painting.

Existing power skirting on custom bracket, skirting to be used as housing for electrical cables for lighting and sockets of new mezzanine structure.

Existing 10mm shadowline between paneling and crit space.

Existing concrete soffit, all holes to be filled, all damage to be repaired. 30% surface colorant applied and prepared for priming. Priming with an undercoat of water with PRIMEX.220 grit sandpaper, "low profile filling paste" applied. Finishing with 1x coat of primer and 1x coat of paint (spray on application).

Paint underside of soffit with PLASCON waterbased, 'one coat ceiling paint', Ultra matt finish. Colour: Brilliant white.

340 x 180 x 6 mm cold-formed rectangular section main bearer beam suspended from existing concrete roof structure with steel cables and rods at 4000 mm centres, to be finished with 1x coat of primer and paint (spray on application) Colour: Platinum grey, RAL 7037.

90 x 100 continuous surface mounted LED luminaire as per REGENT to be fixed onto underside of plywood. Luminaire to be fixed against flat end of lipped channel as indicated on plan. Luminaire to be fitted with 24W/m single LED strip light as per OSRAM.

2 layers of 16 mm shutterply fixed to cold-formed lipped channel beam with M6 Hex head self drilling stainless steel screws, CSK. Plywood sealed with WOODCOTE water-based, quick dry varnish as per MIDAS.

6 mm recycled rubber flooring as per ECOSURFACES, sealed with EcoGuard clear coat, fixed to shutterply with EcoGrip 3 adhesive. Colour: Sundance.

20 mm black powdercoated galvanized mild steel saddle fixed to existing structure with 6 mm nail-in stainless steel nails. Finish: Satin polish #4 (240grit) as per RONSTAN.

Custom edge strip to cover two layers of 16 mm shutterply and one layer of 6 mm rubber flooring.

20 mm powdercoated mild steel conduit to house electrical and lighting cable, conduit to run vertically alongside structural suspension rods.

M24 stainless steel structural tension rod with open body turnbuckle and teardrop tension fork. Code: RONSTAN ARS2M24. Finish: Satin polish #4 (240grit) as per RONSTAN.
5.102. DEVELOPMENT OF TEXTILE UNIT

The textile unit specifically designed for Scenario 2 - division of individual workspaces, acts as the base unit for all the Scenarios. The textile unit has a set of parameters that are adjusted during the fabrication process to suit the parameters and requirements for each of the scenarios. See poster 32 for the fabrication process on page 88.

Further each of the textile units works in conjunction with a rigging system. These rigging systems are what connect the ‘soft’ and ‘hard’ elements. Here the soft elements or textile space-defining elements are the alternative space definers and the hard elements such as the mezzanine and the existing testing site for intervention, act as the traditional space definers. These rigging systems are discussed in greater depth on poster 32 on page 84.
5.10.3. Development of Rigging Systems

The basic rigging details are designed to accommodate the various textile units. The basic rigging details are presented on this poster. Further, the rigging details for the textile unit for scenario 2 are presented in more depth on this poster. See Figure 5.90 - 5.94. These rigging details are indicated where appropriate on sections and further details.

What is a Block and Tackle?

A block and tackle is a system of two or more pulleys with a rope or cable threaded between them, usually used to lift or pull heavy loads. The pulleys are assembled together to form blocks and then blocks are paired so that one is fixed and one moves with the load. The pulley is threaded, on end, through the blocks to provide mechanical advantage that amplifies the force applied to the rope. 

Parts of a Tackle

See Figure 5.97. Parts that make up a tackle (right).

1. Standing block: The block that is anchored and is not moving. This block changes the direction of the running part.
2. Moving block: The moving block is attached to the moving end of the rope (the end the cargo is on).
3. Fall: The fall is the rope that is rove through the block.
4. Standing part: The standing part does not move. It needs to be secured to either the standing block or some other fixed position.
5. Hauling part: The hauling part is the part that is pulled.

Mechanical Advantage: Mechanical advantage is the effect of using blocks and rope to act as a force multiplier. It is the amount by which the pull on the hauling part is multiplied by the tackle. This, in general, is equal to the number of parts of the fall at the moving block (www.rcsccwarrior).

Gun Tackle

See Figure 5.98. Pulley type options (right).

A gun tackle is made up of two single sheave blocks. A gun tackle has a mechanical advantage of 2. (tpub.com) Your effort (E) acts upward upon the arm (EF), which is the diameter of the sheave. The resistance (R) acts downward on the arm (FR), which is the radius of the sheave. Since the diameter is twice the radius, the mechanical advantage (M.A.) is 2. (www.rcsccwarrior).

M.A. = R/E

Rigging and Hardware

Fixing Details

FLOOR FINISH LEGEND:

- 12x200x200 mm existing floor tiles
- 6x1220x7600 mm roll of recycled rubber flooring as per ECOSURFACES, sealed with Ecoguard clear coat, fixed to shutterply with Ecore E-grip 3 adhesive
- Colour: Sundance
- Code: 1217 of 12x200x200 timber floor insert, finished with Arboritic compo water-based sealant as per BEDSON Finish: Clear Matt

RIGGING HARDWARE LEGEND:

- Heavy duty stainless steel oval basket carabiner with straight double locking screw gate and oval eye
- Assorted colour locking gates
- Heavy duty stainless steel double eye oval hook, removable eyes
- Large eye rope splice with whipping
- Brass nickel teardrop rope thimble with side keepers
- M8 Stainless steel collared eye bolt, fixed with backing open nut and spring washer
- 32 mm diameter mild steel rod in 900 mm lengths as suspension rod for textile unit. Rod to be pre-drilled with 8 mm holes at 60 mm from each end.
Fixed head single sheave
standing block with cam cleat
and becket, max. rope diameter 10mm

Single sheave moving block
with becket and eye

Existing structural concrete
beam to be strengthened as
per engineers specifications

GUN TACKLE
10 mm pre-drilled powder coated
galvanised mild steel base plate with
connection plate fixed to underside
of concrete beam with
Chemical Anchor bolts as per
engineers specifications

22 mm diameter 1 x 19 open
strand stainless steel structural
suspension cable with open body
turnbuckle and non-articulated
(fixed) jaw
Code: RONSTAN ARS2M22
Finish: Satin polish #4 (240grit) as per RONSTAN

Open body turnbuckle

General purpose hand winch with
enclosed mechanical components
powder coated finish,
Model HW1500
Lifting capacity: 340kg
Pulling capacity: 680 kg
Gear ratio: 41.0:1

Lowest point of winch handle
at 2155 AFFL,
wind winch to place textile in
storage position

60x60 mm timber handrail fixed onto
powdercoated mild steel flat bar
Colour: Umber grey, RAL 7010

Custom edging strip
100x100x8 mm Square pre-drilled baluster post
base plate, with square post base cover plate fixed
to steel beam with M6 bolts

25x25x2.5 mm square profile balustrade
post fixed at 1000 mm centres

6 mm woodscrew
Balustrade saddle fixed to mid post

8 mm cotton rope with steel core,
rope to be finished with Flametect nitro
water-based fire proofing spray
(hydrophobic and non-corrosive to metals)

#2485 ABOK, Larks head knot
8 mm cotton rope,
to be finished with Flametect nitro
water-based fire proofing spray

M6 bolt secured with
spring washer and nut

Excess running end of main hauling rope
Custom rope cleat (lower half)
Custom rope cleat (top half)
Running end with rope 'sally'

Textile in storage position

Figure 5.91. ANCHOR TO BEAM DETAIL - SCALE 1:10

Figure 5.92. ANCHOR TO MEZZANINE DETAIL - SCALE 1:10

Figure 5.93. ANCHOR TO FLOOR DETAIL - SCALE 1:5

Figure 5.94. RIGGING DETAILS
SCALE 1:2 (left)
5.11. DOCUMENTING THE FABRICATION METHOD

This section provides instructions on the fabrication and construction process of a basic textile sample unit. The type of content and way that the fabrication process is displayed is based on a combination of different principles found in both knitting stitch patterns and friendship bracelets. A knitting stitch pattern typically consists of a description plus an image, diagrammatic instructions accompanied by a symbol key or a set of traditional instructions (Dummies, 2015). See Figure 5.99: Knitting stitch pattern (Craftcookie, 2015) on the opposite page. Friendship bracelets are handmade decorative bracelets knotted from hemp, yarn, linen, silk or cotton. Traditionally Friendship bracelets are worn until they wear through and naturally fall off the arm. The knotting process for making a Friendship bracelet is related to macramé or square knotting (Wisegeek, 2015). See Figure 5.100: Friendship bracelet pattern (Friendshipbracelet, 2015) on the opposite page for an example of a bracelet knotting pattern and knot instructions.

See section 5.9.1. Knot pattern instructions on poster 32 (following page) for the full description and instructions on the fabrication process of an individual textile unit.
Lace ribs 2

**Description**
A lace rib stitch variation with narrow vertical stripes. See also Lace Ribs I and Lace Ribs III.

**Difficulty level**: Easy

**Instructions**
You need a stitch number multiple of $10 + 11 \times 2$ edge stitches. Repeat the pattern between the arrows as many times as you like.

Work right and wrong side rows as shown in the chart. Right side rows (1, 3, etc.) are worked from right to left. Wrong side rows (2, 4, etc.) are worked from left to right.

**Symbol Key**
- + edge stitch
- □ knit 1
- ■ purl 1
- □ 1 yarn over
- □ slip 1 knitwise, knit 1, purl the slipped stitch over
- □ purl 2 together

**Traditional Instructions**
Row 1: edge st, p1, p2tog, k3 * yo, k3, p2, p2tog, k3; repeat from * to last 6 sts, yo, k3, p2, edge st.

Row 2: edge st, k1, sl1kw, k1, pss0, p3, yo, * p3, k2, sl1kw, k1, pss0, p3, yo; repeat from * to last 6 sts, p3, k2, edge st.

Repeat rows 1 through 2.

---

**Figure 5.99.**
KNITTING STITCH PATTERN
(Craft cookie, 2015)

**Figure 5.100.**
FRIENDSHIP BRACELET PATTERN
(Friendship bracelet, 2015)
# HOW TO KNOT A TEXTILE UNIT

**FABRICATION INSTRUCTION SHEET**

## 5.11.1. DESCRIPTION

**Dimensions:** 900 x 2100 mm

**Flat surface area:** 1.89 sq/m

**Approximate weight:** 8-12 kg dependent on type of Filler cord

A rectangular sample composed of cotton rope as Structural cord and Fabric strips as Filler cord. Structural cords and Filler cords are tied together with the aid of a Simple Noose Knot (See diagram indicating left hand oriented knot and right hand oriented knot).

### TERMS

<table>
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<tr>
<th>Term</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary cord</td>
<td>P</td>
</tr>
<tr>
<td>Secondary cord</td>
<td>S</td>
</tr>
<tr>
<td>Structural cord</td>
<td>SC</td>
</tr>
<tr>
<td>Filler cord</td>
<td>FC</td>
</tr>
<tr>
<td>Anchor point</td>
<td>AP</td>
</tr>
<tr>
<td>Facing side</td>
<td>FS</td>
</tr>
<tr>
<td>Backing side</td>
<td>BS</td>
</tr>
<tr>
<td>Cord type set</td>
<td>CTS</td>
</tr>
</tbody>
</table>

## 5.11.2. KNOT PATTERN INSTRUCTIONS

**You will need:**

To complete one hand-knotted sample unit you will need the following:

- Approximately 40 m of 7 mm sash cord or cotton rope as Structural cord (SC). This can be a braided sheath with either a twisted or braided core. Cut these into 9 equal pieces. Temporarily whip the running ends using masking tape.
- Approximately xxx m of 15 mm wide strips of fabric as Filler cord (FC). These can be sewn together without a seam. You will need 8 separate strips of equal length.
- 18 eye bolts (M6 or M8 works well)
- 9 spring gate carabiners (6-8 mm works well)
- A large working frame with M6 or M8 holes (depending on eye bolt size) evenly spaced approximately 100-120 mm apart at the top and bottom of the frame. Note: holes at top and bottom of frame should line up.

### SETUP

- See Figure 5.101: Knot pattern diagram and Figure 5.101: Knot pattern (symbol) key.
- Securely fix one row of 9 eye bolts at the top of the frame, these will be the Top Anchor Points. Securely fix one row of 9 eye bolts at the bottom of the frame. The bottom row of eye bolts should line up vertically with the top row of eye bolts. Clip one carabiner onto each of the top eye bolts. The bottom eye bolts will have no carabiners.
- Ensure that all SC are secured to carabiner at top AP with a larks head knot. Running ends hang freely or if more rigidity is required, running ends can be passed through the eye. The knot is made using the FC. Each row, indicated by a gridline, has to be completed consecutively, starting with row A left to right, row B left to right. Do not start the next row if the previous row of knots are not completed. All knots running down one structural cord follow a left hand right hand pattern.
- Important: Dress each knot after tying. Orient print to Facing side.

## 5.11.3. FABRICATION INSTRUCTIONS

**Figure 5.101.** HOW TO KNOT A TEXTILE UNIT

**Dimensions:** 900 x 2100 mm

**Flat surface area:** 1.89 sq/m

**Approximate weight:** 8-12 kg dependent on type of Filler cord

A rectangular sample composed of cotton rope as Structural cord and Fabric strips as Filler cord. Structural cords and Filler cords are tied together with the aid of a Simple Noose Knot (See diagram indicating left hand oriented knot and right hand oriented knot).
KNOT PATTERN SYMBOL KEY:

- Anchor point (Eye bolt with carabiner)
- Guide line or row allocation (Guide only)
- Knots
- Left hand oriented simple noose knot (See instructions)
- Right hand oriented simple noose knot (See instructions)
- Structural cord, double strands of 7mm cotton rope
- Filler cord, double strands of 15mm fabric strips

KNOT PATTERN DIAGRAM:

KNOT INSTRUCTIONS

LEFT HAND ORIENTED NOOSE KNOT

1. ABOK #2485, Lark's head knot
2. Large eye splice and with whipping
3. Dowel or steel circular pole as AP
4. Rope as AP
5. ABOK #1717, Half hitch—permanently seized with whipping
6. FC running end hangs free
7. SC running end hangs free, finish rope tip with clear whip end dip, finish running end with stopper knot.

UNIT EDGE VARIATIONS

The standard textile unit can be constructed using either a frame or dowel as top anchor point (as described in section xxx: Knot pattern instructions). Further, the top anchor point can remain as part of the finished product or can be replaced with one of the variations as seen below.

A
B
C
D

EDGE VARIATION KEY:

1. ABOK #2485, Lark's head knot
2. Large eye splice and with whipping
3. Dowel or steel circular profile or AP
4. Rope as AP
5. ABOK #1717, Half hitch—permanently seized with whipping
6. FC running end hangs free
7. SC running end hangs free, finish rope tip with clear whip end dip, finish running end with stopper knot.
5.12. MATERIAL SELECTION

The initial testing and making of the sample units were done using Design Team, printed cotton fabric strips. See Section 5.3.4. Testing materials on page 56. However, although cotton is a renewable resource, it has a severe environmental impact (Kadolph 2007: 48). Cotton is a water-intensive crop and mainstream farming methods make extensive use of agricultural chemicals. Although the cotton industry has improved recycling efforts, processing cotton remains an environmental concern (Kadolph 2007: 49). Organic cotton is a more environmentally friendly option, however additional costs related to lower fibre yields and the absence of hazardous chemicals results in organic cotton costing approximately twice as much as conventional cotton (Kadolph 2007: 50).

Further issues such as durability, light resistance (colour fastness), overall appearance retention and maintenance influenced the final decision on fabric fibre selection. See Table 5.10: Fibre ratings related to performance (Kadolph 2007: 28) on the opposite page, for a comparison of various fibre types. The final selected fibre type is a polyester and cotton blend. See Figure 5.103. Material selection, Fabric samples and Table 5.12: Fabric specification on poster 34 (following page). Polyester is sometimes referred to as ‘...the workhorse fibre of the industry...’ and is the most widely used synthetic fibre (Kadolph 2007: 131). See Table 5.11: Properties of polyester on the opposite page (Kadolph 2007: 132).

5.12.1. FINISHING AND MAINTENANCE

Due to the nature and overall focus of the project finishing and maintenance is only briefly considered.

Finishing:

Fire retardence is defined as ‘the resistance to combustion of a material when tested under specified conditions’ (Kadolph, 2007: 375). Flame-retardent finishes can be used on fabrics such as cotton, rayon, nylon and polyester. These finishes should be nontoxic, noncarcinogenic and be durable enough to withstand approximately 50 washes. Further, they should not affect texture or hand of the fabric and should also not contain any unpleasant odours (Kadolph, 2007: 376).

Most topical finishes require special care in laundering in order to preserve flame resistance.

The fabric strips will not receive any additional finishing; however, the rope will be finished with Flametect Nitro Water-based fire proofing spray/dip. This finish is hydrophobic which will help protect the cotton rope against water and dirt.

Maintenance:

The temporal nature of the textile installation means that textile units that are dirty, damaged or fatigued can easily be replaced. The textiles can be hand-knotted on site and assembled in place of the textile unit being removed.

Further than this, any additional cleaning can be done through regular vacuuming of the textile as well as scheduled dry cleaning or washing of the textile unit. Vacuuming can be done by staff on site.
**Table 5.10.**
**Fibre Ratings Related to Performance**
(Kadolph, 2007: 28).

<table>
<thead>
<tr>
<th>Rating</th>
<th>Abrasion resistance</th>
<th>Thermal retention</th>
<th>Resiliency</th>
<th>Light resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>Aramid</td>
<td>Wool</td>
<td>Nylon</td>
<td>Glass</td>
</tr>
<tr>
<td></td>
<td>Fluoropolymer</td>
<td>Acrylic</td>
<td>Wool</td>
<td>Acrylic</td>
</tr>
<tr>
<td></td>
<td>Nylon</td>
<td>Modacrylic</td>
<td>Modacrylic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Olefin</td>
<td>Polyester</td>
<td>Polyester</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>Saran</td>
<td>Olefin</td>
<td>Olefin</td>
<td>Sulfar</td>
</tr>
<tr>
<td></td>
<td>Spandex</td>
<td>Nylon</td>
<td>Acrylic</td>
<td>Lyocell</td>
</tr>
<tr>
<td></td>
<td>Flax</td>
<td>Aramid</td>
<td>Modacrylic</td>
<td>Flax</td>
</tr>
<tr>
<td></td>
<td>Acrylic</td>
<td></td>
<td>Polyester</td>
<td>Cotton</td>
</tr>
<tr>
<td></td>
<td>PBI</td>
<td></td>
<td></td>
<td>Rayon</td>
</tr>
<tr>
<td></td>
<td>Sulfar</td>
<td></td>
<td></td>
<td>PBI</td>
</tr>
<tr>
<td></td>
<td>Cotton</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Silk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>Wool</td>
<td>Silk</td>
<td>Silk</td>
<td>Triacetate</td>
</tr>
<tr>
<td></td>
<td>Rayon</td>
<td>Spandex</td>
<td></td>
<td>Acetate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Olefin</td>
</tr>
<tr>
<td>Poor</td>
<td>Vinyon</td>
<td>Flax</td>
<td>Lycocell</td>
<td>Nylon</td>
</tr>
<tr>
<td></td>
<td>Acetate</td>
<td>Cotton</td>
<td>Flax</td>
<td>Wool</td>
</tr>
<tr>
<td></td>
<td>Glass</td>
<td>Lyocell</td>
<td>Cotton</td>
<td>Silk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rayon</td>
<td>Rayon</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acetate</td>
<td>Acetate</td>
<td></td>
</tr>
</tbody>
</table>

**Table 5.11.**
**Performance Properties of Polyester**
(Kadolph, 2007: 132).

<table>
<thead>
<tr>
<th>Properties of polyester</th>
<th>Importance to consumer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resilient- wet and dry</td>
<td>Easy care</td>
</tr>
<tr>
<td>Dimensional stability</td>
<td>Machine-washable</td>
</tr>
<tr>
<td>Sunlight-resistance</td>
<td>Good for curtains and draperies</td>
</tr>
<tr>
<td>Durable, abrasion-resistant</td>
<td>Industrial uses</td>
</tr>
<tr>
<td>Aesthetic superior to nylon</td>
<td>Blends well with other fibres</td>
</tr>
</tbody>
</table>
knotting instructions

FABRIC SELECTION

Table 5.12.

FABRIC SPECIFICATION:

Table 5.13.

FABRIC SELECTION:

KNOTTING INSTRUCTIONS

TEXTILE UNIT SCENARIO ONE

Figure 5.104.

TEXTILE UNIT SCENARIO ONE

Figure 5.103.

KNOT PATTERN DIAGRAM
SCENARIO ONE
Part 2
5.12.2. ASSEMBLY PROCESS

Basic assembly for the individual textile unit is discussed in Section 5.9.1. Unit edge variations on the previous page. This section provides a brief overview for the assembly of textile unit scenario two.

**STEP ONE**
Fixing Standing block to existing structure. See Figure 5.91. Anchor to beam detail on poster 32.

**STEP TWO**
Fixing Moving block to Standing block. See Figure 5.97. Parts that make up a tackle on poster 32.

**STEP THREE**
Ballustrade with custom rope cleat. See Figure 5.92. Anchor to mezzanine detail on poster 32, and Figure 5.87. Anchor to mezzanine detail front view on poster 31.

**STEP FOUR**
Fixing point to mezzanine floor. See Figure 5.93. Anchor to floor detail on poster 32.

**STEP FIVE**
Fixing point to existing floor. See rigging detail 2 (RD2) on poster 32 for more detail.

### PARTS FOR ASSEMBLY:
(for one textile unit)
- 2x Fixed head single sheave standing block with cam cleat and becket, max. rope diameter 10mm
- 2x Single sheave moving block with eye becket, max. rope diameter 10mm
- 2x Heavy duty stainless steel oval basket carabiner with straight double-locking screw-gate and swivel eye. Assorted colour locking gates.
- 2x 8mm Nylon teardrop rope thimble with side keepers
- 6x Heavy duty stainless steel double eye swivel hook, removable eyes.
- 4x Large eye rope splice with whipping
- 1x 32 mm diameter mild steel profile in 900 mm lengths as suspension rod for textile unit. Profile to be pre-drilled with 8 mm holes at 60 mm from each end.

### ORDER OF ASSEMBLY

**TEXTILE UNIT SCENARIO ONE**

Table 5.13.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Rand per Unit</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>SASH CORD</td>
<td>7 mm diameter Cotton rope Colour: Natural (CC273)</td>
<td>38m</td>
<td>R5.00 p/m</td>
<td>R190.00</td>
</tr>
<tr>
<td>TEXTILE INFILL</td>
<td>Calico 2800 mm wide roll cut into 100-120 mm wide strips, 56 strips 5000 mm long</td>
<td></td>
<td></td>
<td>R650.00</td>
</tr>
<tr>
<td>CARABINER</td>
<td>Heavy duty stainless steel oval basket carabiner with straight double-locking screw-gate and swivel eye. Assorted colour locking gates.</td>
<td>2</td>
<td>R60.00</td>
<td>R120.00</td>
</tr>
<tr>
<td>DOUBLE EYE SWIVEL HOOK</td>
<td>Heavy duty stainless steel double eye swivel hook, removable eyes.</td>
<td>6</td>
<td>R80.00</td>
<td>R480.00</td>
</tr>
<tr>
<td>EYE BOLT</td>
<td>8x80 Stainless steel eye bolt</td>
<td>2</td>
<td>R8.00</td>
<td>R16.00</td>
</tr>
<tr>
<td>THIMBLE</td>
<td>8mm Nylon teardrop rope thimble with side keepers</td>
<td>2</td>
<td>R6.00</td>
<td>R12.00</td>
</tr>
</tbody>
</table>

**COSTING PER UNIT:**

R1468.00

R960.00

Item Description | Quantity | Rand per Unit | Total cost |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SASH CORD</td>
<td>7 mm diameter Cotton rope Colour: Natural (CC273)</td>
<td>38m</td>
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</tr>
<tr>
<td>TEXTILE INFILL</td>
<td>Calico 2800 mm wide roll cut into 100-120 mm wide strips, 56 strips 5000 mm long</td>
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<td></td>
</tr>
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<td>CARABINER</td>
<td>Heavy duty stainless steel oval basket carabiner with straight double-locking screw-gate and swivel eye. Assorted colour locking gates.</td>
<td>2</td>
<td>R60.00</td>
</tr>
<tr>
<td>DOUBLE EYE SWIVEL HOOK</td>
<td>Heavy duty stainless steel double eye swivel hook, removable eyes.</td>
<td>6</td>
<td>R80.00</td>
</tr>
<tr>
<td>EYE BOLT</td>
<td>8x80 Stainless steel eye bolt</td>
<td>2</td>
<td>R8.00</td>
</tr>
<tr>
<td>THIMBLE</td>
<td>8mm Nylon teardrop rope thimble with side keepers</td>
<td>2</td>
<td>R6.00</td>
</tr>
</tbody>
</table>

**FABRIC SPECIFICATION**

### SCENARIO ONE

(Not to scale)
5.13. SCENARIO THREE INITIAL DEVELOPMENT

The textile unit for scenario three is constructed with the same knots as in the textile units for scenarios one and two. The knotting pattern for scenarios one and two are 'łat' patterns. This means that the textile sample unit can be knotted using the knotting process as described on poster 33. (By means of a knotting frame). However, the knotting pattern for scenario three would be slightly different. See Figure 5.108, right.

Due to the three-dimensionality of the scenario three knotting pattern, the basic 'łat' pattern first had to be fully developed. This basic 'łat' pattern then forms the basis for the development of a three-dimensional knotting pattern. The images below illustrate the initial development of the textile unit for scenario three.
Figure 5.108 (below) indicates the initial textile fabrication diagram for the three-dimensional knotting patterns. Further development would indicate knot count and structural cord length. Once these two aspects are determined, approximate material usage and weight can be calculated. This would allow for more accurate specification of rigging hardware, rails and pulleys.

Figure 5.109 indicates the preliminary development of a textile unit for the computer lab. This installation is a combination of the individual textile unit and a further development of the three-dimensional textile unit.

1. Build scaled model
2. Measure lengths of string, these then form the Primary cords
3. Calculate lengths of Secondary cord
4. Determine knot density in order to determine length of Filler cords.
5. Make scaled sample piece of large textile
6. Determine weight of final textile
7. Adjust rigging hardware and structural cordage

Figure 5.110 indicates the testing box with textile, scenario three (above).
5.14. POSSIBILITIES AND RESTRICTIONS OF HAND-KNOTTED TEXTILES

Due to the parameters and requirements of the Hybrid research strategy, possibilities and restrictions of the hand-knotted rope and rope-like textiles were discovered and discussed throughout the making process. All observations, in terms of the possibilities and restrictions, can be found within Table 5.5, Test Matrix on poster 12, page 58. With each possibility or restriction (design cycle test result) a response and plan followed. These steps are documented graphically in Figure 5.20, Flow diagram on poster 13, page 59. Further, the major possibilities are discussed in the reflection sections of the design cycles and can be found on poster 14-17, page 60-63.

The knowledge gained through the process of making in terms of the material, the manner in which it responds to certain influences and the spatial possibilities and restrictions are applied during the intervention design cycles.

In summary,

- Textiles, specifically hand-knotted rope and rope-like textiles, possess an aesthetic and metaphysical quality that can not be duplicated with the use of traditional or conventional 'hard' space-defining elements. Therefore, textiles offer opportunity for unique spatial manifestations.
- Textiles create a unique connection between the user and the interior environment as it is always 'present between the body and the hard fabric of the building...' (Hoskyns, 2007: 87). To add to this, Hoskyns (2007:87) says that:
  
  For interior architecture not to include soft furnishings [textiles] is to strip the discipline of its relationship with the body, positioning it with the building rather than the body.

- Textile performs well in tension but does not naturally perform well as a 'structure' under compression.
- Textiles or fabric is naturally flat, but hand-knotted rope and rope-like textiles are inherently textured and bulky, offering opportunities for acoustic and visual spatial design responses.
- Textiles possess characteristics that allow for spatial responses that are adaptable and temporary. The temporality of textiles further offer interest in terms of user interaction and change.
5.15. CONCLUSION

This chapter introduced the conceptual thinking behind the design response in the form of a large conceptual diagrammatic image board. The design process was described and applied to the various test sites in order to fully explore the hand-knotted textile. The design cycles were documented and include planning, making, observation and written reflection. The design process culminates in textile space-defining elements placed within the test site for intervention. Finally, the chapter offers a short summary on the possibilities and restrictions of hand-knotted textiles.